

March 13, 2008

## **Revised Mourning Dove Harvest Management Strategy For the Western Management Unit**

### **INTRODUCTION**

This revised harvest management strategy provides guidelines for cooperative establishment of mourning dove (*Zenaida macroura*) hunting regulations in the Western Management Unit; it supersedes the initial mourning dove harvest management strategy established and approved in 2004. This revised strategy is only a transition step towards implementation of the strategy envisioned in the **Mourning Dove National Strategic Harvest Management Plan** (National Plan; Anonymous 2005). The initial composite trend models used as the basis of the strategy outlined in this document will likely be replaced by population models in ≤5-years pending continued and expanded support for a banding and wing survey programs, and research generating information fueling the population models.

### **BACKGROUND**

The future of dove management depends primarily upon harvest management and our understanding of how harvest affects dove populations. Increasingly, there has been broad-scale support for improving the information used in the decision making process for mourning dove harvest management. In 2001, a National Mourning Dove Planning Committee was formed and developed a plan of action that would lead to guidelines that technical committees could use to prepare harvest management plans for their respective management units. The National Plan was approved by all 4 flyway councils in August, 2003. The plan outlined a new vision of information-based decision making compared to the status quo of singly relying on population trends from roadside indices. The USFWS Regulations Committee (SRC), however, requested the respective management unit technical committees develop an interim mourning dove harvest management strategy given available information (e.g., CCS indices). This request was based upon a perceived idea that the recently approved National Plan, although a step in the right direction, would not provide useful assistance in the harvest regulation process for several years.

During 2004, initial harvest management strategies were developed by technical committees in each of the three management units. Each of the three respective harvest strategies represented a different approach and used different data in establishing hunting regulations. Although the Service accepted the initial strategies, they explicitly stated the strategies would not be approved until a more thorough review was conducted. The review occurred in 2006, and the initial strategies were found to be insufficient for several reasons. In 2006, the Service requested the technical committees to develop revised strategies using similar existing data among management units, similar decision criteria, and three regulation options (i.e., liberal, moderate, and restrictive).

In cooperation with Dave Otis, Philip Dixon, and John Sauer, the technical committees began work in 2006 to revise harvest strategies following the 2006 guidelines from the Service. The new approach uses hierarchical modeling techniques to produce composite estimates of dove trends at the management unit scale. These trend models are then used to generate posterior probability distributions of management unit trend for a specified number of years, and these distributions are then used in a decision analysis framework to establish quantitative criteria for

harvest regulation change. Composite estimates of trends are derived using 4 data sources: Call-Count Survey (CCS) doves heard (CCS<sub>H</sub>; 1966 – 2006), CCS doves seen (CCS<sub>S</sub>; 1966 – 2006), North American Breed Bird Survey (BBS; 1966 – 2006), and indirect population growth rate estimates (2003 – 2006) calculated from harvest and banding data.

For purposes of this plan, our *explicit assumption* is that doves are habitat generalists we assume that harvest (at some level) affects dove abundance. Given that assumption, our *management goal* is optimize harvest in a sustainable fashion. This will be accomplished by learning how changes in hunting regulations affect changes harvest rates, vital population rates, and ultimately population abundance and harvest.

## **SYNTHESIS OF A WMU HARVEST STRATEGY**

Philosophically, a meaningful harvest management strategy should be based on estimated parameters that have direct interpretation and biological meaning in the context of wildlife population dynamics; e.g., population size, harvest rate, survival rate, etc. Secondly, the decision criteria used to initiate harvest regulation changes should be explicit and quantitative, and derived from knowledge of the population characteristics for various alternative hypotheses and the related forces governing population dynamics. Thus, the procedure outlined here using roadside indices is only a transitory step toward a more biologically meaningful decision criteria.

In constructing harvest strategies in a particular management unit, current regulations are likely considered to be moderate, with those moderate regulations being used to derive more restrictive and more liberal regulations. Changes in regulations, however, must be substantial enough to actually affect harvest rates; modest changes often address social rather than biological issues (Peterson 2001), and are unlikely to influence harvest rates, and ultimately the population. Traditionally, season length and bag limits have been the primary means to regulate mourning dove harvest under federal frameworks (Reeves 1993).

### ***Daily Bag Limits***

As a guide to assessing appropriate bag limits for a restrictive hunting regulations package, cumulative frequency distributions for mean bag were examined for the WMU. Cumulative frequency distributions of mean bags would be expected to vary with dove population abundance and region. Three years of available HIP data (1999–2001) were used to calculate mean bag per hunting trip for the state within the WMU. These ranged from a low of 4.1 in Oregon and Utah to 6.7 in Arizona (Table 1). Percentages of hunters achieving mean bags are approximately linear for the WMU although it varies somewhat among states

Mean bag limit was approximately linear for most states and for the WMU overall (Fig. 1) and ranged between 0–9 doves. A bag limit reduction from 10 to 8 would thus affect approximately 30% of hunters in the WMU; reduction from 10 to 5 would affect approximately 50%. Bag limits for all states within this time period was 10 doves. Because of higher mean bags in Arizona, California, and Washington (Table 1), slightly higher percentages of hunters would be affected by those same reductions in those same states.

To evaluate the affect that a range of bag limits reductions would have on state and WMU harvest, the same HIP 1999–2001 data was used. For this period, bag limit was 10 doves for all states in the unit. To calculate probable percent reductions in harvest, bag reductions for those data were simulated by assigning higher harvests to the reduced bag limit and divided the

new sum for dove harvest by the previous harvest sum for each state and the WMU. For example, to test the effect of a 8 bird bag limit, each 10 and 9 bird harvest record in the data was set to 8, the number of doves harvested for this new simulated dataset was summed, and compared to the original data.

Based on this exercise, a reduction in bag limit from 10 to 8 is likely to result in an 11% reduction in harvest (Table 2). Since hunting is anecdotally estimated to be a fourth to a fifth of all annual mortality in mourning doves (Sadler 1993; 225), smaller reductions in dove harvest are unlikely to result in measurable gains in mourning dove abundance. Harvest is dependent on dove abundance and hunter skill, thus the percent reductions in Table 2 will not apply to all years and abundance levels. However, the estimated percent harvest reductions likely underestimate the actual reductions that would result from bag restrictions for two reasons: 1) non-response bias within the HIP survey questionnaire results in overestimates of mean bag, and 2) a bag limit of less than 10 may discourage hunters from hunting doves and thus lead to fewer hunters in the field. Again, this exercise explicitly assumes no change in hunter effort and/or hunter numbers. Therefore scenario 2 is likely to cause a more reduced dove harvest in practice than the 11% reduction estimated from the exercise illustrated in Table 2.

### ***Season Length***

The reproductive behavior of doves, behavior of dove hunters, and hunting history should be considered when setting season length for mourning doves. Reproductive behavior is important because a central principle of wildlife management is avoiding the disruption of breeding cycles. Behavior of dove hunters is important because hunting behavior determines harvest. Hunting history is important because season start and end dates have resulted from many years of regulatory adjustments and are the accepted norm.

In the Western Management Unit, available HIP data indicate that the differences in season length likely have minimal impact on mourning dove harvest. In the WMU the vast majority of states have usually achieved  $\geq 60\%$  of their estimated dove harvest by late September to the middle of October

Given these data, a prudent set of regulatory options would adjust bag limit and keep the number season days consistent with current frameworks. Those frameworks include a 60-day season in Arizona and California, and 30-day seasons in Idaho, Nevada, Oregon, Montana, Washington, and Utah. This recommendation is also justified by the ‘early-season’ of dove hunting; in other words, most hunting occurs early during the season. Minor adjustments to the length of the season only adds or subtracts days from the end of the season when it has little demonstrated impact, and confounds our ability to learn how specific management activities (i.e., daily bag) affect harvest rates within the context of the National Plan.

It is important to explicitly recognize that daily bag and season length have some synergistic relationship to affect mourning dove harvest. Given our current limited understanding of that relationship and hunter behavior that would result from changes in dove regulation packages however, it is important to first learn how (or if) changes in daily bag can impact harvest rates (and ultimately the population) before making changes in the season length.

### ***Composite Trend Statistics***

The strategy proposed here presumes that regulation decisions will be made based solely on composite population trends during a specified time frame. The composite trends will be

estimated from four data streams; i.e., CCS-heard, CCS-seen, BBS, and population growth rates (Figure 2). It is assumed that there are 3 regulation alternatives, which are generically referred to as 1) restrictive, 2) liberal, and 3) moderate. The simple idea is that if the composite trend is at or below some pre-determined lower threshold value with some specified level of statistical confidence, then regulations would be restricted. If the trend is at or above an upper threshold value with some specified level of statistical confidence, then regulations are liberalized. If the trend is between the 2 thresholds, then moderate or standard regulations are in place.

The first step in developing composite trends was to generate adjusted annual indices for each state by using Bayesian hierarchical modeling to adjust route counts for observer and year effects, missing data and statistical distribution violations (Figure 3). It is important to recognize that this technique does not adjust for a consistent trend in detectability caused by unknown sources, e.g., change in roadside habitat. Each of the 3 surveys is modeled independently. These analyses have been completed for all surveys and states. The indirect population estimates are assumed to be unbiased and are not adjusted. The degree of congruence among the adjusted CCS and BBS survey trends within states, and the extent to which individual survey trends were smoothed by the hierarchical modeling, varied considerably.

Next, a second hierarchical analysis was performed that used all 4 data sources to produce a composite abundance estimate for the management unit (set on a log scale) and an associated credibility interval for each year. The WMU roadside survey trends show a basic consistency of trend indicators (Figure 2). The average relative weights of each of the 4 data sources in the composite indices were approximately 0.19 (CCS<sub>S</sub>), 0.33 (CCS<sub>H</sub>), 0.29 (BBS) and 0.15 (population estimate). The composite estimate has an upper and lower bound (Figure 3). From the set of annual composite counts, a posterior probability distribution (PPD) of a trend estimate can be derived for any time interval. The PPD of the trend estimate plays the critical role in the decision framework for setting harvest regulations.

Implementation of a decision framework requires specification of 6 parameters:

- time interval,
- annual rate of change during the selected time interval that will trigger a liberalized harvest regulation (L),
- probability ( $P_L$ ) that the trend estimate (T) is equal to or greater than L in the PPD,
- annual rate of change during the selected time period that will trigger a restricted harvest regulation (R),
- probability ( $P_R$ ) that the trend estimate (T) is less than or equal to R in the PPD
- and the number of years the regulatory package remains in place.

These decisions will be driven by biological and human dimension considerations within each management unit. The criteria provide the flexibility to implement a wide spectrum of regulatory options accommodating a wide range of considerations. Following is a framework using these decision criteria in a harvest regulation decision-making process.

### ***The WMU Harvest Strategy and Decision Criteria***

#### **Step 1 –**

Earlier, we established the rationale for using daily bag as our criterion variable affecting dove populations.

**Step 2 –**

We also established the rationale for three regulation options consisting of restrictive (8 doves), moderate (10 doves), and liberal (12 doves) packages (Table 3).

**Step 3 –**

Next, we selected the 5-year average of the composite trend (Figure 4) because the purpose of this strategy is to detect increases or declines in dove populations over the short-term.

**Step 4 –**

Next, we established the annual rate of change of 5.0% during the 10-year trend that would trigger either a liberalized ( $L = 0.05$ ) or restrictive ( $R = -0.05$ ) regulation; the moderate regulations package would fall between -0.05 and 0.05 annual change of the estimated 5-year average. We specified the probability of an increasing trend to be 80% ( $P_L = 0.80$ ), and the probability of a decreasing trend to 80% ( $P_R = 0.80$ ). For example, if 80% of the PPD of the trend estimate is above the a priori 0.05 annual trend decision criteria, then a liberal regulation would be used. This approach ensures we would be reasonably certain that the estimated trend is increasing (i.e., enacting a liberal regulation) or decreasing (i.e., enacting restrictive regulation) before making the necessary regulation change. The reason for selecting an 80% probability is somewhat arbitrary; however, given the short-term nature and the relative imprecision of the trend indicators, 80% is a reasonable starting point.

**Step 5 –**

Lastly, we set a 3-year period to hold the regulation constant to see if and how the trend is impacted by the selected regulation option.

**Step 6 –**

With these criteria established a priori (Figure 5) the hierarchical models can be updated annually with current trend information to estimate trends and posterior probability distributions. The package will change only when 80% of the illustrated curve is contained either on the left (-0.05 population decline) or right (0.05 population increase) of the pre-selected triggers.

To see how this framework would have performed with past data, we calculated composite trend indicators and their probabilities for the WMU from 1980 to 2005. During those years, no regulatory changes would have been imposed, although the year 1987 came closest to triggering a restricted season (Figure 6). This is reasonable since in those years dove populations appeared to decline in the WMU (based on  $CCS_H$  alone). Similar declines within the next 5 years could lead to a restricted package.

This document should not be interpreted as a recommendation for discontinuation of the  $CCS$ , other available population trend indices, or other population monitoring and research efforts. Although roadside indices have previously acknowledged shortcomings, they provide the only available indices to long-term trends of mourning dove abundance. This situation presents populations managers with a dichotomous conundrum. In other words, it is the only tool we currently have to monitor dove populations (along with other surveys with similar

challenges), but without it there are few mechanisms for validating the composite trend models or the long-term mechanistic population models. Inferences derived from this quasi validation procedure, although acknowledged to be weak, provide the best available check of reality until a reliable trend of population abundance becomes available.

## **LITERATURE CITED**

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Reeves, H. M. 1993. Mourning dove hunting regulations. Pages 429-448 *in* T. S. Baskett, M. W. Sayre, R. E. Tomlinson, and R. E. Mirarchi, editors. *Ecology and management of the mourning dove*. Stackpole books, Harrisburg, PA, USA

Sadler, K. C. 1993. Mourning dove harvest. Pages 449-458 *in* T. S. Baskett, M. W. Sayer, R. E. Tomlinson, and R. E. Mirarchi, eds., *Ecology and management of the mourning dove*. Wildl. Manage. Inst., Washington, D.C., USA

Table 1. Mean bag for mourning doves for the seven states within the WMU for 1999–2001 combined (Harvest Information Program data). Means and standard errors were calculated from a randomized block design that treated individual hunters as a random effect. Standard error was calculated from the data and does not include non-response error.

<b>State</b>	<b>Mean Bag</b>	<b>Standard Error</b>	<b>N</b>
<b>Arizona</b>	<b>6.7</b>	<b>0.09</b>	<b>1062</b>
<b>California</b>	<b>6.3</b>	<b>0.08</b>	<b>1424</b>
<b>Idaho</b>	<b>5.1</b>	<b>0.14</b>	<b>542</b>
<b>Nevada</b>	<b>4.8</b>	<b>0.17</b>	<b>426</b>
<b>Oregon</b>	<b>4.1</b>	<b>0.15</b>	<b>505</b>
<b>Utah</b>	<b>4.1</b>	<b>0.09</b>	<b>1263</b>
<b>Washington</b>	<b>6.1</b>	<b>0.15</b>	<b>457</b>
<b>WMU</b>	<b>5.4</b>	<b>0.04</b>	<b>5679</b>

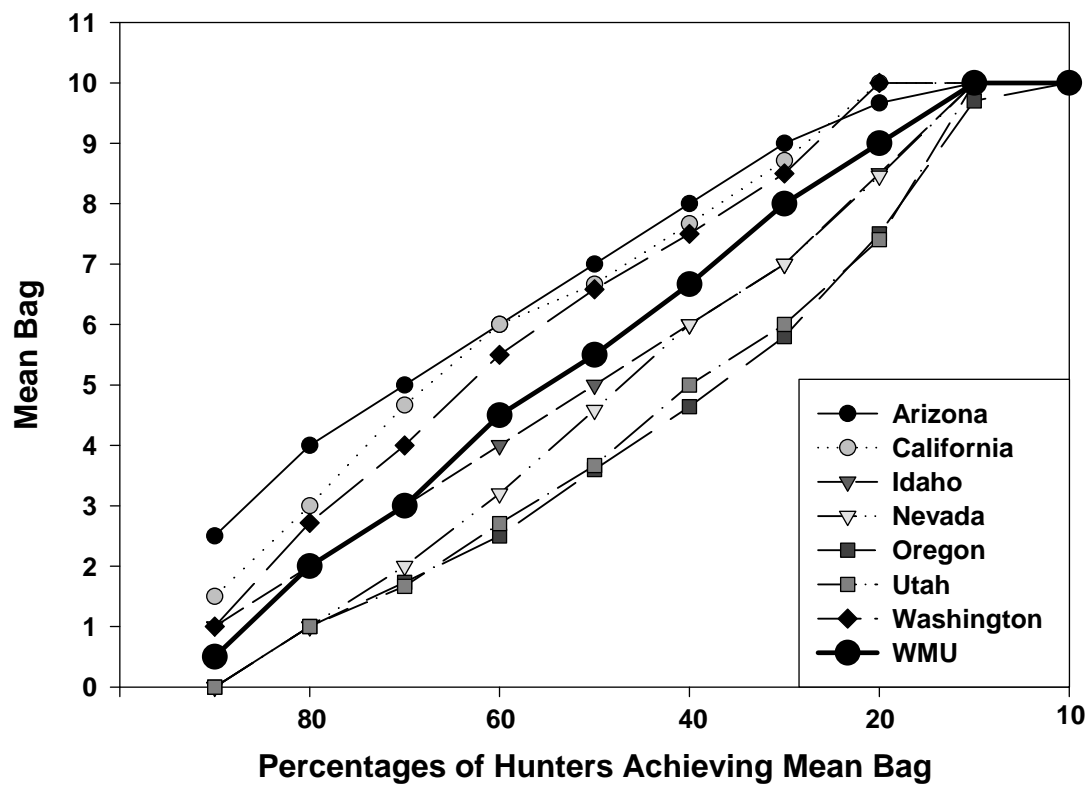
Table 2. Estimated percent reduction in mourning doves harvest at various bag limit reductions for the states within the WMU. Estimates were calculated from preliminary HIP data, 1999-2001. During this period, all states were under 10 day bag limits. Season lengths were 60 days in Arizona and California and 30 days in the other states.

<b>Bag reduced from 10 to</b>	<b>State % reduction in harvest</b>							<b>WMU % reduction in harvest</b>
	<b>AZ</b>	<b>CA</b>	<b>ID</b>	<b>NV</b>	<b>OR</b>	<b>UT</b>	<b>WA</b>	
9	6	6	4	5	4	4	6	5
8	12	12	10	10	9	9	12	11
7	20	19	16	17	15	15	20	18
6	29	28	23	24	22	22	28	26
5	38	37	32	33	30	30	37	35
4	49	48	42	43	40	40	48	46
3	61	60	54	55	51	52	59	58
2	74	72	67	68	65	65	72	70
1	87	86	83	83	81	82	85	85

Table 3. Hunting seasons options based on composite trends and posterior probability distributions (PPD).

<b>Coposite Population Trend</b>	<b>Estimated annual rate of change</b>	<b>Proportion of Estimated Trend</b>	<b>WMU Daily Bag Limit<sup>1</sup></b>
$t > 0.00$ (increasing trend)	$\hat{t}_L > 0.05$	$P_L \geq 0.80$	12 (20% increase in bag limit, and an unknown harvest increase)
$t = 0.00$ (stable trend)	$\hat{t}$ is between -0.05 and 0.05	--	10 (moderate; no change in bag limit)
$t < 0.00$ (declining trend)	$\hat{t}_R < 0.05$	$P_R \geq 0.80$	8 (20% decrease and an estimated 11% or greater harvest reduction)

<sup>1</sup>Proposed hunting season framework assumes adoption of 60-day season and single bag-limit option.



**Figure 1.** Percentages of hunters achieving mean bags for mourning doves for individual states within the WMU. Percentiles and mean bags were calculated from preliminary Harvest Information Program data from 1999–2001 ( $n = 5679$ ).

## Adjusted WMU Trends

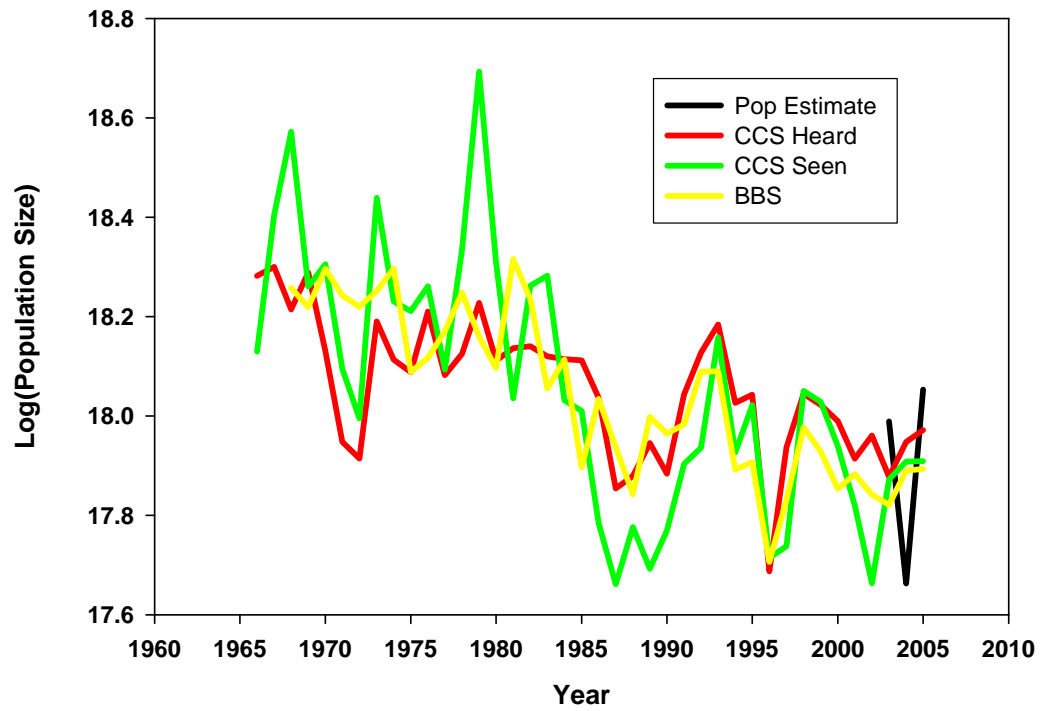


Figure 2. Adjusted roadside survey trends (Call-Count Survey Heard, Call-Count Survey Seen, and North American Breeding Bird Survey) and the population growth rate estimator.

### Composite WMU Trend and Credibility Intervals

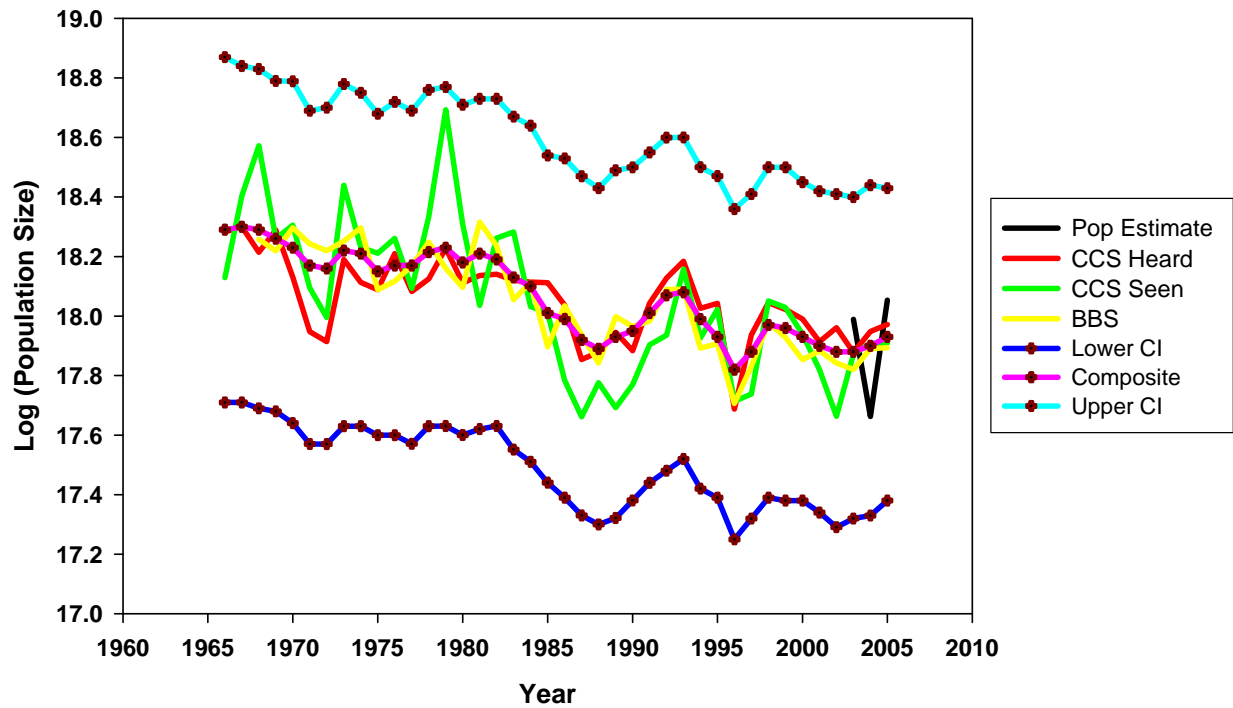


Figure 3. Composite trend and credibility intervals for roadside surveys (Call-Count Survey Heard, Call-Count Survey Seen, and North American Breeding Bird Survey) and the population growth rate estimator.

## Posterior Probability Distributions for WMU Trends

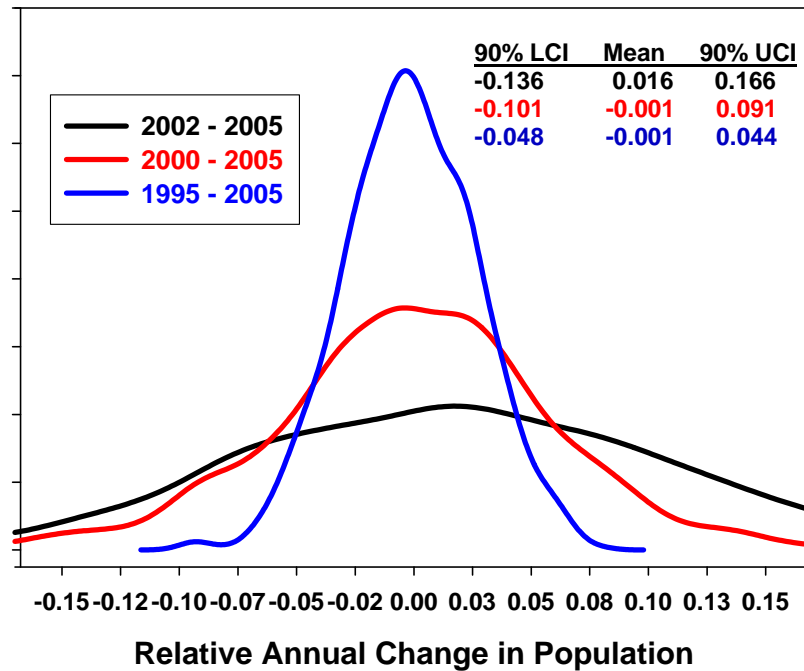


Figure 4. Example Posterior Probability Distribution (PPD) of the trend estimate calculated for Western Management Unit (WMU) trends for 3-year, 5-year, and 10-year periods. Note that these PPD of the trend estimate are only examples, and final trends and PPD used for decision making may look different.

### Posterior Probability Distribution for 1995-2005 WMU Trend

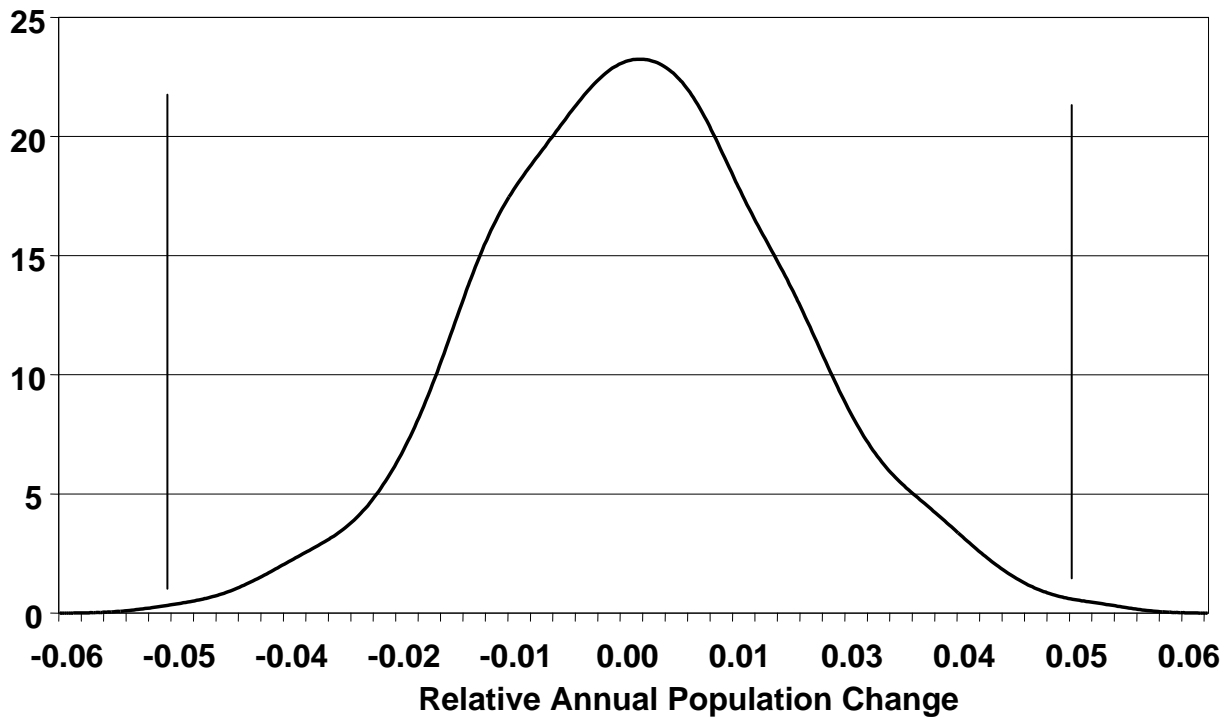


Figure 5. The harvest strategy regulation process involves establishing a priori trend guidelines before the actual trend and Posterior Probability Distribution (PPD) for the specified time interval. In this case, our decisions for changing harvest regulations will be based upon detecting an annual 0.05 change in the estimated trend with a liberal regulation being triggered at  $P_L \geq 0.80$  and  $P_R \geq 0.80$ . This is only an example showing the trend and PPD of the trend estimate showing that the moderate regulation package would be place using the a priori criteria outlined in Table 3.

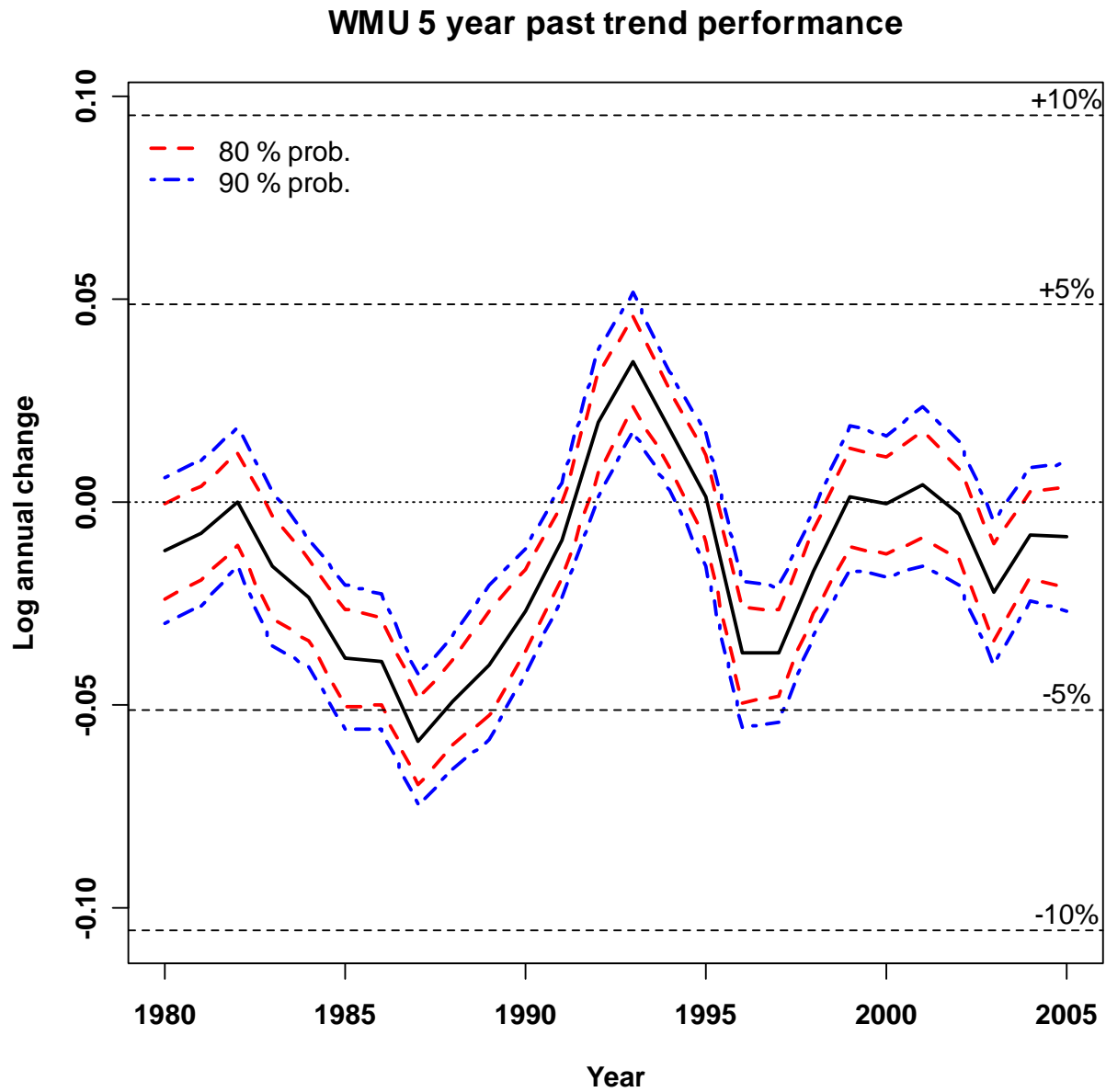


Figure 6. Trend performance of the posterior probability estimates based on a 5-year trend with 80% and 90% probability intervals in the WMU from 1980 to 2005. Note that to trigger a regulation change with these data, both the probability intervals (dashed lines above) should be outside of the selected 0.05 rate of change criteria.